June 23, 1925. 1,543,420

E. W. COOPER

SPEED CONTROLLING MECHANISM

Filed March 4, 1922 4 Sheets-Sheet 1

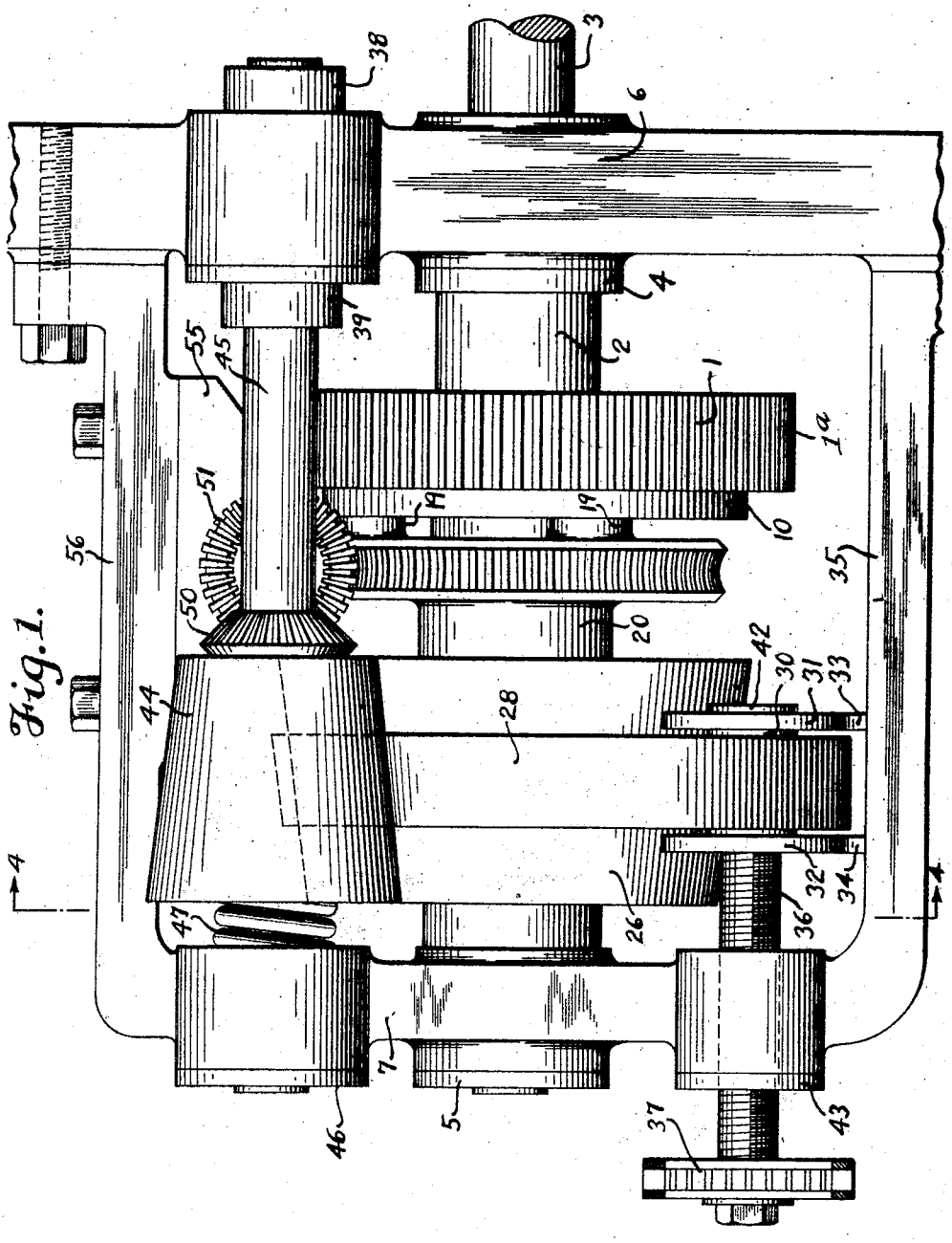


Fig. 1.

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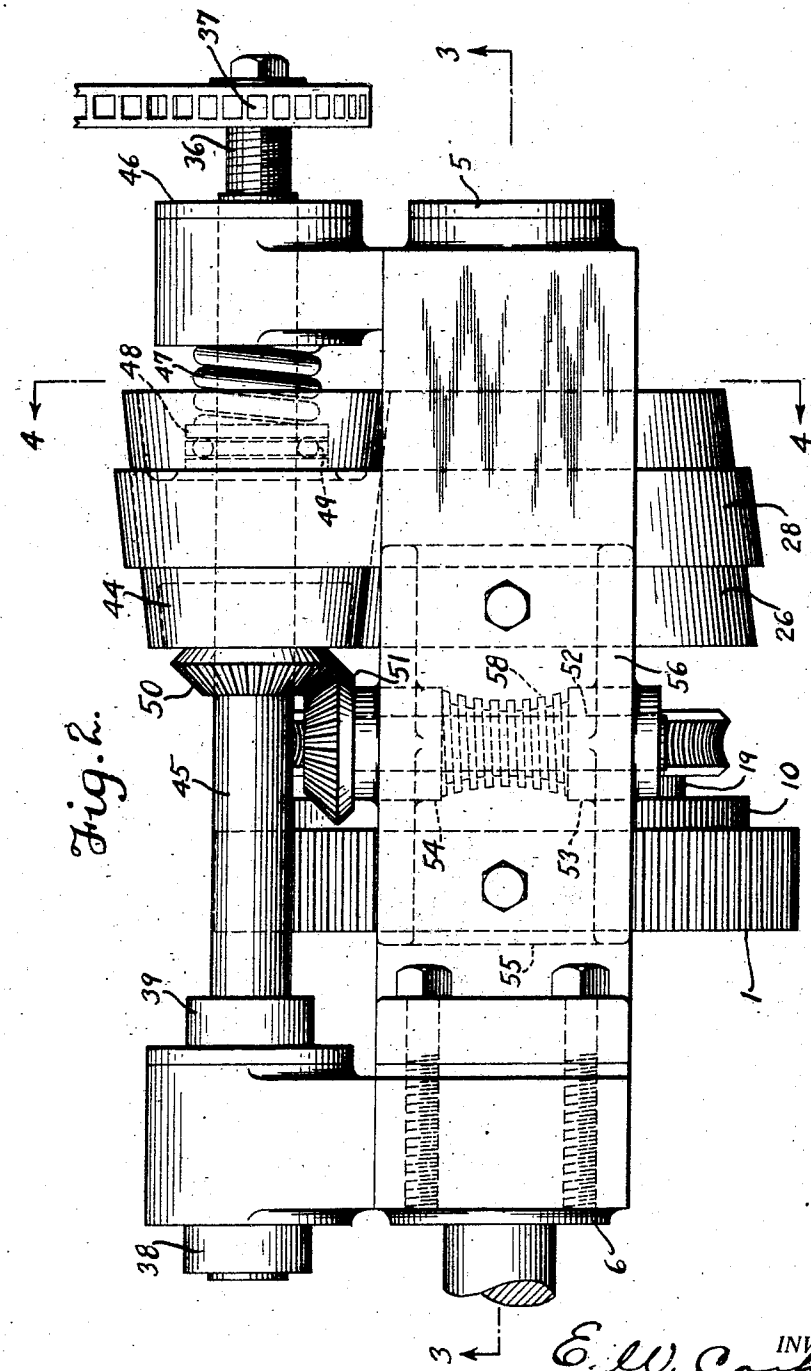


Fig. 2.

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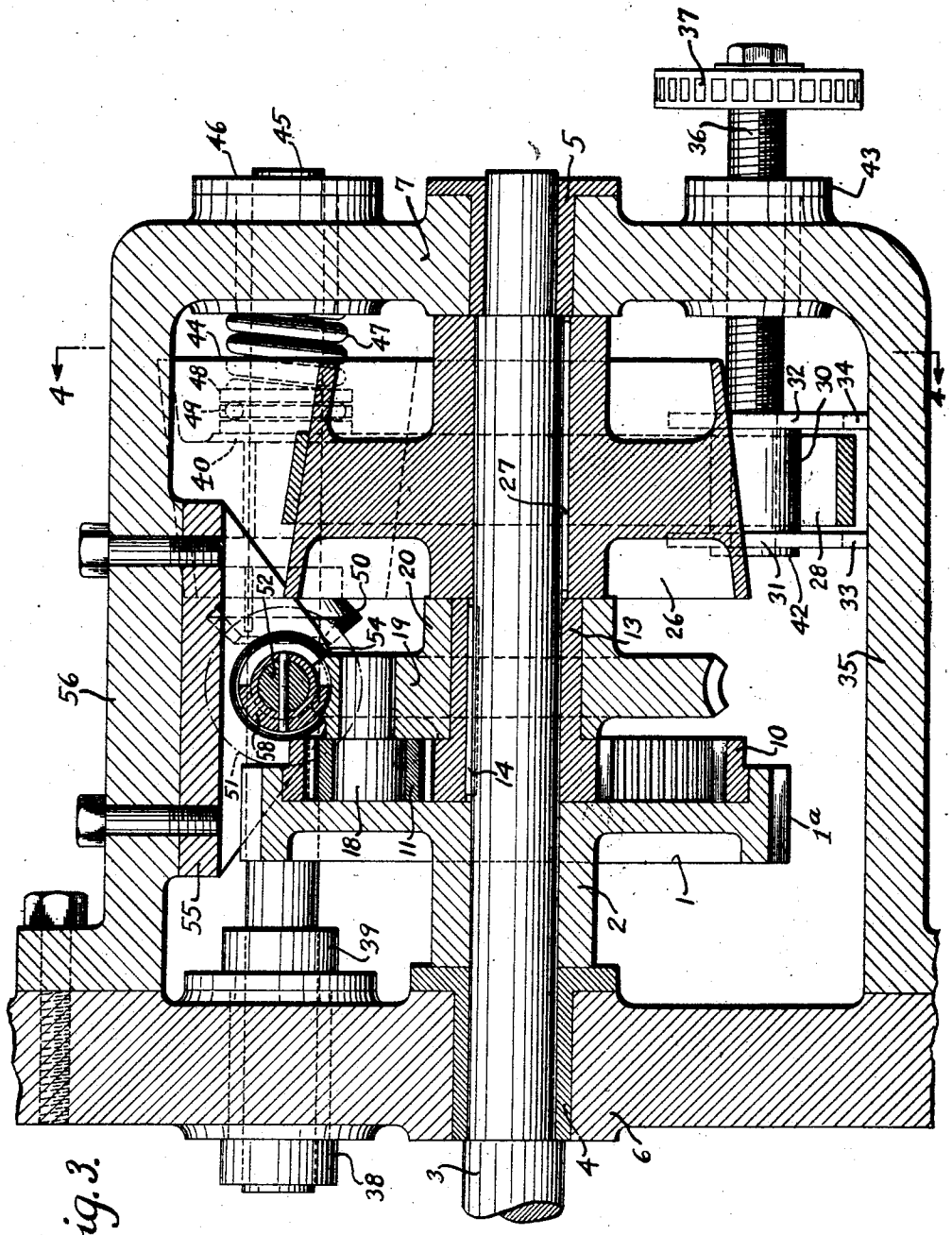


Fig. 3.

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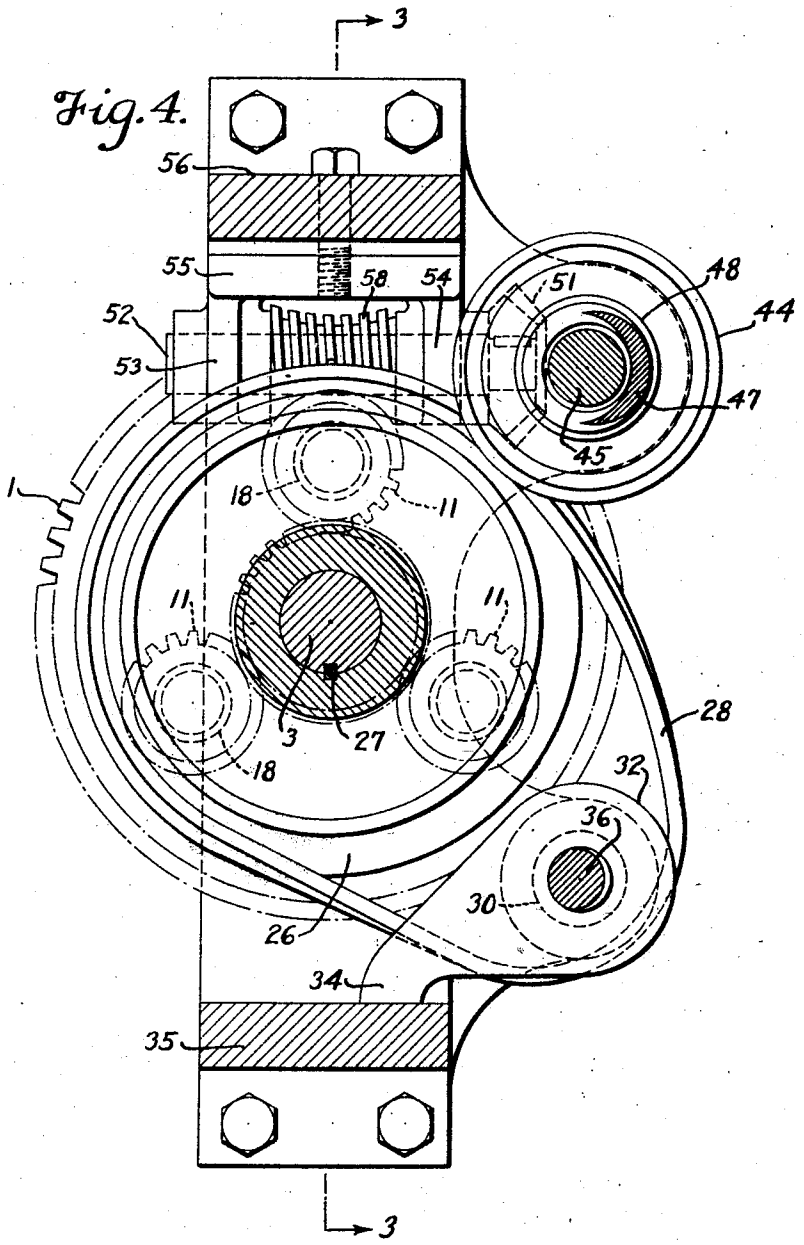
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Filed March 4, 1922 4 Sheets-Sheet 4

Fig. 4.



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UNITED STATES PATENT OFFICE.

ELLIS W. COOPER, OF NEW YORK, N. Y.

SPEED-CONTROLLING MECHANISM.

Application filed March 4, 1922. Serial No. 541,152.

To all whom it may concern:

Be it known that I, ELLIS W. COOPER, a citizen of the United States, residing at New York, in the county and State of New York, have made certain new and useful Improvement in Speed-Controlling Mechanism, of which the following is a specification.

The invention relates to driving mechanisms for machines and speed regulating devices therefor, and more particularly to such driving mechanisms and to cooperating means for varying the speed ratio between a driving and a driven member.

Objects and advantages of the invention will be set forth in part hereafter, or will be obvious herefrom, or may be learned by practice with the invention; the same being realized and attained through the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings herein referred to and constituting a part hereof, illustrate one embodiment of the invention and together with the description serve to explain the principles thereof.

Of the drawings:

Fig. 1 is an elevation of a mechanism embodying the invention;

Fig. 2 is a top plan corresponding to Fig. 1;

Fig. 3 is a longitudinal central vertical section taken substantially on the line 3—3 of Figs. 2 and 4; and,

Fig. 4 is a transverse vertical section taken substantially on the line 4—4 of Figs. 2 and 3.

The principal object of the invention is to produce a simple and highly efficient mechanism for variably regulating the speed of a driven member relatively to the speed of a driving member, and therein providing a very nice and accurate adjustment of the speed ratio between the driving member and the driven member.

More in detail, and having in view the present preferred embodiment, the principal object of the invention is very nicely and accurately to vary, and thereby regulate, the speed ratio between a driving gear and a driven shaft so that with a constant or given drive or driving speed of the gear, the speed of the shaft may be slightly varied therefrom with great precision and accuracy.

An example of the application of the invention is where two printed webs of paper must be fed into exact association and registration, so that the pages of one web will register absolutely accurately with the pages of the other web. Where webs are printed in different printing couples, and especially when printed in different machines, it is practically impossible to have the pages of the two webs of exactly the same size or exactly in the same interrelation, and any such variation constitutes a cumulative error which, with a constant or non-variable speed of feeding the two webs, would soon bring them entirely out of register.

Where the present invention is applied to the driving mechanism for one of the web rolls, it will be possible to impart the slight yet very nice and exact variation of speed to one of the roll feeds whereby the two webs may be continuously associated in absolute registry one with the other. In this exemplary instance, the shaft may be a part of the web roll feed, whether this be a peripheral frictional feed or any other kind of suitable feed mechanism. It will be clear that the invention is also applicable to other kinds of mechanisms.

In accordance with certain features of the invention, and as preferably embodied, means are provided whereby the greater part of the driving effort or force is positively supplied, and only the small variations from the normal speed are effected or compensated by frictional means. Thereby the frictionally operated speed varying devices may be made very much smaller and more sensitive and a very much nicer and more precise graduation of speed can be obtained and uniformly maintained.

In the preferred embodiment, and carrying out the objects and features of the invention already broadly set forth, there are provided a driving gear and a driven shaft, with gearing connecting the two to effect the drive, together with means for controlling this connecting gearing to change the angular relative speed of the driving gear and the driven shaft.

This is preferably effected by imparting as desired or necessary plus or minus additional angular movement to some portion of

the connecting gearing. As already stated this is preferably effected by an auxiliary mechanism, which is likewise preferably a frictional mechanism, one member of which is positively driven from either the driven shaft or driving gear. It will be understood also that the shaft may do the driving and that the gear may be driven, this being a mere mechanical reversal.

It will be undestood that the preceding general description and the following detailed description are exemplary and explanatory of the invention, and are not restrictive thereof; and that other features and objects of the invention will be first set forth in connection with the following detailed description.

Referring now in detail to the embodiment of the invention illustrated by way of example in the accompanying drawings, a driving gear 1 (which may optionally be the driven gear or driven member) has its hub 2 loosely mounted for independent rotation on the driven shaft 3 (which shaft may in turn be the driving member). This gear may be provided with external gear teeth 1^a for receiving a driving force from a driving gear (not shown). The shaft 3 is journaled in bushings 4 and 5, mounted respectively in the frame members 6 and 7. Fixed to the inner face of the rim of the gear wheel 1 is an internal gear ring 10 and meshing with the internal gear ring 10 (Figs. 3 and 4) are a plurality of gear pinions 11.

The pinions 11 also mesh with a gear wheel 12, having a hub sleeve 13, which is fixed to rotate with the shaft 3 by a key 14. The geared pinions 11 are journaled, respectively, on stub shafts 18, which are fixed to and project from an angularly movable or rotable member 19, which is preferably a worm wheel, having its hub 20 loosely journaled for independent rotation on the sleeve 13, which it will be recalled is the hub of the gear wheel 12, which gear wheel is fixed to the shaft 3. The worm wheel 19, it will be understood, is a part of the mechanism for varying or controlling the speed ratio between the gear wheel 1 and the shaft 3.

According to certain features of the invention, the speed ratio varying or controlling mechanism is preferably frictionally operating. As embodied a cone pulley 26 is fixed on shaft 3 to rotate therewith by suitable means, such as a key 27. Running in contact with the cone pulley 26 is a shiftable speed-regulating endless belt 28. The shifting mechanism therefor, as embodied, comprises a spool or spool-like member 30, having end flanges 31 and 32 at either side of the belt, to keep it in position and guide it and to effect the speed-changing movement thereof. These flanges are provided with outwardly projecting heels 33 and 34, which engage with the reach 35 of the frame to prevent rotation of the spool.

In the embodied form of means for driving belt 28 to and fro, spool 30 is internally apertured to receive the end of a shaft 36, which is rotatable within the spool, being held longitudinally in place by a collar 42 on the end of the shaft, and by a shoulder on the shaft against which the spool flange 32 abuts. Shaft 36 is screw-threaded into a bushing 43, mounted in the frame piece 7 and correspondingly internally screw threaded. Suitable means are provided for rotating the screw-shaft 36, such as a hand wheel or sprocket wheel 37, in one direction or the other to slide the spool 30 and therewith the belt 28 longitudinally or across the cone pulley 26.

Cooperating with cone pulley 26, is a cone pulley 44, the belt 28 running therebetween in the usual manner. Cone pulley 44 is splined on a shaft 45, to rotate therewith but has slight longitudinal movement thereon. Shaft 45 is journaled at 46 and 47 in the machine frame and is held in place by collars 38 and 39. Cone pulley 44 is pressed into frictional engagement with the belt 28 by a spring 47, coiled about the shaft 45 in tension between the frame end 7 and the friction plate 48 of a ball bearing 49, which bears against the hub 50 of the cone pulley 44.

Fixed on shaft 45 is a beveled gear 50, with which meshes a beveled gear 51, which latter is fixed on a shaft 52. This shaft is journaled in brackets 53 and 54 integral with the plate 55, which is bolted to the frame reach 56. Fixed on shaft 52 is a worm 58, with which meshes the worm-wheel 19 already described.

The manner of operation of the mechanism just described is substantially as follows:

Assuming, as has exemplarily been done, that the gear wheel 1 is the driving member, the gear wheel may be driven in any suitable manner, or by any suitable mechanism, and at any desired speed. The internal gear ring 10, being fixed to the gear wheel 1 rotates therewith, and through the pinions 11 will impart rotation to the gear wheel 12 which is fixed to the shaft 3 to rotate therewith. Thereby a certain speed of rotation will be imparted from the gear wheel 1 to the shaft 3, the speed ratio of the gear wheel and the shaft being dependent upon and determined by the gear ratio of the gear ring 10, the pinions 11 and the gear wheel 12, in a well known manner. This may be conveniently styled the normal speed ratio of the driving member and the driven member.

It will be clear, however, that if the pinion 11 be rotated in one direction or the other at a slightly greater or less speed, the gear

wheel 12 will rotate correspondingly either more rapidly or more slowly with respect to the gear wheel 1 than the normal speed ratio just referred to. By rotating the screw shaft 36, the belt 28 may be moved along the cone pulley 26, either to the left in Fig. 3 to increase the speed of the cone pulley 44 relatively to that of pulley 26 or to the right in that figure to decrease the relative speed of the cone pulley 44. This will correspondingly vary the rotational speed of worm wheel 19, and thereby impart the requisite and already described subtractive or additive angular movement to the worm wheel, and thus will correspondingly increase or decrease the speed ratio of the gear wheel 1 and the shaft 3.

From all the foregoing it will be understood that a mechanism has been provided realizing the objects and advantages hereinbefore set forth, together with other objects and advantages; and further that departures may be made from the exact structure shown and described, within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:—

1. A speed varying and controlling mechanism, comprising a driven shaft, a driving gear freely rotatable on the shaft and having external gear teeth for receiving a driving force, and also having internal gear teeth, a worm wheel loosely mounted on the shaft, a planetary pinion mounted on the worm wheel meshing with the internal gear teeth on said gear wheel, a gear wheel fixed to rotate with the shaft and meshing with the pinion, a shaft perpendicular to the driven shaft and having a worm meshing with the worm wheel, and connections for rotating the worm and worm wheel proportionately to the rotation of said shaft.

2. A speed varying and controlling mechanism, comprising a driven shaft, a driving gear freely rotatable on the shaft and having external gear teeth for receiving a driving force, and also having internal gear teeth, a worm wheel loosely mounted on the shaft, a planetary pinion mounted on the worm wheel meshing with the internal gear teeth on said wheel, a gear wheel fixed to rotate with the shaft and meshing with the pinion, a shaft perpendicular to the driven shaft and having a worm meshing with the worm wheel, connections for rotating the worm and worm wheel proportionately to the rotation of said shaft, and means, cooperating with said connections, for varying the ratio of the rotation of the worm wheel to the shaft, as desired.

3. A speed varying and controlling mechanism, comprising a driven shaft, a driving gear freely rotatable on the shaft and having external gear teeth for receiving a driving force, and also having internal gear teeth, a worm wheel loosely mounted on the shaft, a planetary pinion mounted on the worm wheel meshing with the internal gear on said gear wheel, a gear wheel fixed to rotate with the shaft and meshing with the pinion, a worm meshing with the worm wheel, and a double-cone variable speed drive connected to the shaft and to the worm wheel, for varying the relative speed of rotation of the driving gear and driven shaft.

4. A speed varying and controlling mechanism, comprising a fixed casing, a shaft extending through the casing and journaled in opposite walls thereof, a gear rotatably mounted on said shaft, a gear keyed to said shaft, a planetary gear meshing with the two aforesaid gears, a worm gear for driving the planetary gear, and means cooperating with the shaft, for driving the worm gear and planetary gear at different speeds with relation to the speed of the shaft.

5. A speed varying and controlling mechanism, comprising a fixed casing, a shaft extending therethrough and journaled in opposite walls thereof, a gear having external and internal gear teeth and journaled on said shaft, a second gear fixed on said shaft, a planetary gear meshing with the internal gear teeth of the first gear and with the second gear, a worm gear for driving the planetary gear, and means, cooperating with the shaft, for driving the worm gear and planetary gear at different speeds with relation to said shaft.

6. A speed varying and controlling mechanism, comprising a fixed casing, a shaft extending therethrough and journaled in opposite walls thereof, a gear having external and internal gear teeth and journaled on said shaft, a second gear fixed on said shaft, a planetary gear meshing with the internal gear teeth of the first gear and with the second gear, a worm gear for driving the planetary gear, a second shaft journaled at its opposite ends in the casing, and substantially parallel to the first mentioned shaft, means operatively connecting said second shaft with the worm gear, and means for driving said second shaft at different speeds with relation to the first shaft.

7. A speed varying and controlling mechanism, comprising a fixed casing, a shaft extending therethrough and journaled in opposite walls thereof, a gear having external and internal gear teeth and journaled on said shaft, a second gear fixed on said shaft, a planetary gear meshing with the internal gear teeth of the first gear and with the second gear, a worm gear for driving the planetary gear, a second shaft, journaled at its opposite ends in the casing and arranged substantially parallel to the first shaft, means operatively connecting said second shaft with the worm of the worm

gear, and means comprising two cones, respectively fixed to the first and second shafts, for driving the second shaft at various speeds with relation to the first shaft.

8. A speed varying and controlling mechanism comprising a driven shaft, a driving gear loosely mounted thereon and having external gear teeth for receiving a driving force, and also having internal gear teeth a gear fixed to the shaft, a planetary gear meshing with the two said gears, a worm gear for rotating the planetary gear, a double-cone variable speed drive for driving the worm gear at different speeds, a friction belt located between the two cone members of the variable speed gear, and means including a threaded shaft for shifting the friction belt.

In testimony whereof, I have signed my name to this specification.

ELLIS W. COOPER.